

Chapter 3 – The Science Content Standards
Grade One

INTRODUCTION

First grade students learn about the general properties of solids, liquids, and gases. They also learn about the needs of plants and animals, and the functions of some of their external structures. Students also learn how to use simple weather recording instruments, such as thermometers and wind vanes, and to discuss daily and seasonal changes in weather. First grade students are adept at identifying the characteristics of objects and can either record those observations through pictures and numbers or begin to use written language. They can learn how to make new observations when discrepancies exist between two descriptions of the same object or phenomenon.

The English-language arts standards require writing brief expository descriptions about people, places, things, and events using sensory details. These expository descriptions could be aligned with the science standards that require students to record observations and data using some written language. Teachers should guide students to respond to who, what, when, where and how questions. Students expand their vocabulary by learning appropriate grade level scientific terms (such as freezing, melting, heating, dissolving, and evaporating).

STANDARD SET 1: Physical Science

Background

Students learn the general differences and similarities between properties common to all solids, liquids, and gases. The first grade physical science standards provide a foundation for the study (in grade three) of evaporation and the changes in states of matter that may occur when solids and liquids are heated.

Description of the Standards

1. Materials come in different forms (states), including solids, liquids, and gases. As a basis for understanding this concept:

a. Students know solids, liquids, and gases have different properties.

Solids have definite shapes, meaning they are rigid, and occupy a specific volume. This distinguishes solids from liquids and gases whose fluid nature (or ability to flow) results in their shape being determined by the shape of whatever vessel contains them.

The properties of a solid can be demonstrated by collecting a variety of solid objects of different shapes, sizes, weights, and textures.

The fluid nature of a liquid can be demonstrated by pouring water between same-sized measuring cups of different shapes. This shows that each cup holds the same amount of liquid although the shapes are different. Distorting a partially inflated balloon

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into a variety of shapes shows that gases do not have a definite shape, and pushing the balloon into a container of water shows the amount of volume of water excluded by the gas.

Students can draw pictures, and tell or write stories that illustrate the differences between the properties of solids, liquids, and gases.

- b. Student know the properties of substances can change when the substances are mixed, cooled, or heated.

Students can be taught that melting requires heating, and freezing requires chilling. It may be helpful to use a thermometer to establish whether the temperature of a substance is increasing or decreasing before and after melting occurs. As ice water is heated, the temperature does not increase until the ice is melted. Students should begin to understand that some changes are reversible (like ice melting), and some are irreversible (like an egg cooking). Salt may be dissolved in water and recovered through evaporation as another example of a reversible process. Mixing baking soda with vinegar produces irreversible change, marked by the carbon dioxide gas bubbling up from the vinegar as the baking soda converts into soluble sodium acetate and water.

STANDARD SET 2: Life Sciences

Background

First grade students are ready to focus on the favorable habitats (usually including air and soil), water, and energy supply (sunlight or food) that living organisms need to survive. Students will learn about the ways that plants and animals live in different environments and will discuss the relationship between structural form and function.

Description of the Standards

2. Plants and animals meet their needs in different ways. As a basis for understanding this concept:
- a. Students know different plants and animals inhabit different kinds of environments and have external features that help them thrive in different kinds of places.

Students learn about the types of organisms that live in different environments and how they have adapted to their surroundings. For example, marine mammals off the Pacific coast typically have thick, blubbery skin (e.g. whales) or thick fur (e.g. sea otters) to keep from being chilled by the cold water. Giraffes have long necks that help them to reach leaves near the tops of trees and spot predators from greater distances. These are examples of adaptations that students can readily discuss. There are many stories and videos about plants and animals that can help students learn about life on earth.

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- b. Student know both plants and animals need water; animals need food, and plants need light.

Learning what plants and animals need to survive is one of the foundations of ecology. Plants and animals both need water and air. Plants and animals also both need a source of energy. Plants absorb sunlight and animals eat food to meet their respective energy requirements. Plants and animals obtain what they need to survive through the environmental adaptations described above.

If plants are kept in the classroom, students can learn about their needs by caring for them. Students may enjoy field trips or walks in locations that have shrubs and grasses that attract small animals (particularly birds, lizards, and insects). To supplement these activities, the school library provides many good stories that describe plants and animals that live in a variety of environments.

- c. Students know animals eat plants or other animals for food and may also use plants or even other animals for shelter and nesting.

This standard introduces students to the fact that all living organisms in an environment are interdependent. For example, some birds nest in shrubs and trees; insects (such as fleas) may inhabit dogs, cats, and other mammals. Animals may assist plant reproduction by spreading seeds.

Students can observe that insects eat the leaves of shrubs and grass and that this activity will attract additional small animals, such as birds and lizards, which eat the insects. Such observations and discussions introduce students to the idea of a food chain. Teachers should point out to their students that people are at the top of the food chain.

- d. Students know how to infer what animals eat from the shape of their teeth (e.g. sharp teeth: eats meat; flat teeth: eats plants).

This standard introduces the biological concepts of structural form and function, which are discussed extensively in later grades. A cat's sharp, pointed teeth are well-suited for ripping and tearing the meat it eats, while the flat teeth of a cow are well-suited to grinding and chewing the tough grasses it consumes. Students can study different specimens of teeth, including skeletal examples and fabricated models. They can find pictures of different kinds of teeth (carnivores and herbivores) in library books. Students can examine their own teeth using mirrors and observe, record, and report to the class which teeth they use when eating different types of food (front teeth or back teeth). A relationship between teeth and the food that animals eat can be taught while taking a field trip to the zoo or having a naturalist speak to the students.

- e. Students know roots are associated with the intake of water and soil nutrients and green leaves are associated with making food from sunlight.

This standard is complementary to standard 2d above as it emphasizes the relationship between plant structures and their functions. Students learn that roots take in water and nutrients from the soil. Green leaves are the sites where photosynthesis turns

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sunlight into food. If students have plants growing in the classroom, they may observe and record how the plants respond to different growing conditions. For example, a plant growing near a window may turn its leaves towards the light source and change its direction of growth to improve its ability to make food.

STANDARD SET 3: Earth Science

Background

Students learn that each season has its own predictable range and trends of weather conditions. They also learn how to use simple equipment to make measurements of weather conditions. To prepare students for studies in higher grades, they should learn that the earth receives energy from sunlight and that the warming of the earth has a strong influence on the weather.

Description of the Standards

3. Weather can be observed, measured, and described. As a basis for understanding this concept:

a. Students know how to use simple tools (e.g. thermometer, wind vane) to measure weather conditions and record changes from day to day and across the seasons.

Students learn how to use a thermometer and a wind vane to measure weather conditions. They may also make a simple rain gauge to improve the quality and detail of their weather observations, measurements, and records. In discussing their findings, they have opportunities to improve their vocabulary and expressive language. Students should have experience with recording day-to-day and seasonal changes in weather, but teachers should limit the time spent on these activities. For example, if students spent only 10 minutes per day making measurements and discussing trends in the weather, the instructional time dedicated to this activity would amount to 30 hours over the course of a school year.

b. Students know that the weather changes from day to day, but those trends in temperature or rain (or snow) tend to be predictable during a season.

Teachers may wish to keep an eye on the weather report and set aside instructional time to record weather conditions during a week in which precipitation or high winds are expected. They may also have students record data during a different week in which the weather is expected to be relatively stable. In bringing student attention to these two differing sets of data, a spirited discussion may develop. Although it is difficult to predict the weather, teachers should not encourage uninformed guesses. Historical data on temperature, wind, and rainfall conditions are typically collected for every city, often by stations located at airports. These data are freely available on the Internet and are a useful resource.

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- 1 c. Students know the sun warms the land, air, and water.

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3 Radiation from the sun is ultimately responsible for atmospheric circulation and
4 the earth's weather, a fact that is introduced in first grade and mastered in grade 5. First
5 grade students can be made aware of the warming effect of the sun's rays on their skin,
6 and can be shown that the air, land, and water are similarly warmed. For example,
7 students can see that on a sunny day the asphalt of their playground is cool in the
8 morning but hot by midday. On a cloudy day, the asphalt may stay cool all day.

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10 **STANDARD SET 4: Investigation and Experimentation**

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12 **Background**

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14 Students continue to develop their ability to make quantitative observations and
15 comparisons by recording and using numbers. Recording requires careful observing,
16 comparing, and ordering of objects and events. Not to be overlooked is teaching students
17 to revisit their observations. This is best done when students find that they have different
18 descriptions of the same object or event. Also important is the fact that an observation of
19 change depends on having a "fixed" reference point. We know an object has moved only
20 because its position has changed with respect to a reference point.

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22 **Text of the Standards**

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24 4. Scientific progress is made by asking meaningful questions and conducting
25 careful investigations. As a basis for understanding this concept and addressing
26 the content in the other three strands, students should develop their own questions
27 and perform investigations. Students will:
28 a. Draw pictures that portray some features of the thing being described.
29 b. Record observations and data with pictures, numbers, or written statements.
30 c. Record observations on a bar graph.
31 d. Describe the relative position of objects by using two references (e.g.: above and
32 next to, or below and left of).
33 e. Make new observations when discrepancies exist between two descriptions of the
34 same object or phenomena.